Online prediction without assumptions: expert aggregation and optimization

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We consider problems of sequential prediction, where the goal is to predict one at a time the values of a sequence $y_1, y_2, \ldots$ (for instance, the y_t may be binary), while minimizing some notion of cumulative error over time. A typical approach in statistics would involve assuming that the signal comes from a stochastic process, then estimating its parameters and providing theoretical guarantees on the quality of the predictions, valid under the assumption that the signal is sampled from a stochastic process.

In this talk, we present the point of view of *prediction of individual sequences* [1], under which we work without any assumption on the nature of the signal. Given access to a family of *experts*, which provide predictions on the values of the signal, we show that it is possible to predict almost as well as the best one (in terms of cumulative error), for *every* possible sequence of outcomes (including ones chosen by an adversary).

We then discuss an extension of the above *expert aggregation* problem, namely online convex optimization [2], for which it is also possible to obtain guarantees valid for all sequences. Finally, we conclude by mentioning some recent research topics on the subject.

References

[1] Nicolò Cesa-Bianchi and Gábor Lugosi. *Prediction, Learning, and Games*. Cambridge University Press, Cambridge, New York, USA, 2006.

[2] Elad Hazan. Introduction to online convex optimization. *Foundations and Trends in Optimization*, 2(3-4):157–325, 2016.